

**REMARKS**

Applicant has studied the Office Action dated June 19, 2008 and has made amendments to the claims. In particular, claim 1 has been cancelled and a new independent claim 22 has been drafted and presented for examination. It is submitted that the application, as amended, is in condition for allowance. By virtue of this amendment, claims 2-22 are pending.

Reconsideration and allowance of the pending claims in view of the above amendments and the following remarks are respectfully requested. In the Office Action, the Examiner:

- Rejected claims 1, 3, 4, 9, 10, 11, 13, 14, 18 and 20 under 35 U.S.C §103(a) as being unpatentable over Fraden (US 4,509,527) in view of Miller (US Patent No. 5,796,340).
- Rejected claims 2 and 12 under 35 U.S.C §103(a) as being unpatentable over Fraden in view of Miller in view of Sackner (US 2002/0032386).
- Rejected claims 6 under 35 U.S.C §103(a) as being unpatentable over Fraden in view of Miller in view of Cornish (US 2006/0247543).
- Rejected claims 5, 7, 8, 15, 17 and 19 under 35 U.S.C §103(a) as being unpatentable over Fraden in view of Miller in view of Porges (US 4,510,944).
- Rejected claims 8 and 19 under 35 U.S.C §103(a) as being unpatentable over Fraden in view of Miller in view of Sackner in view of Porges.
- Rejected claim 16 under 35 U.S.C §103(a) as being unpatentable over Fraden in view of Miller in view of Sackner in view of Cornish.
- Rejected claim 21 under 35 U.S.C §103(a) as being unpatentable over Fraden in view of Miller in view of Brider (US 6,491,647).

**I. Status Summary**

Following the Office Action, claim 1 has been cancelled and a new claim 22 has been drafted and presented for examination. Further, claims 2-6 and 9-11 have been amended in order to clarify and more particularly indicate the claimed subject matter.

No new matter has been introduced by the new claims in the present amendment. Reconsideration of the application as amended and based on the arguments set forth herein below is respectfully requested.

## II. Overview of the Current Invention

The object of the present invention is to monitor heartbeat and respiration rates of a patient (subject) lying, possibly sleeping, on a mattress. The system comprises an array of independent pressure sensors placed under a mattress on which the patient lies. The sensors are arranged to sense vertical pressure applied thereon. A control and processing unit is operable to receive from the sensors vertical pressure signals exhibiting changing pressure levels over time (hereinafter: vertical pressure signals) and calculate a horizontal signal therefrom, by subtracting one vertical signal from another vertical signal. Thus, the system and the method according to the present invention enable extraction of horizontal signals exhibiting mass movements of the patient attributed to blood circulation by eliminating the common vertical movement components. The horizontal signal is then analyzed for detecting heartbeat rate.

In addition, the use of various filtering techniques is suggested in order to improve the analysis of the horizontal signal. Specifically, the use of a high pass filter whose frequency is at least twice the heart frequency of a predefined heartbeat rate (possibly the patient's) is suggested in order to detect the peaks along the horizontal signal caused by the heartbeats.

## III. Claim Rejection under 35 U.S.C §103(a)

Examiner rejected claims 1, 3, 4, 9, 10, 11, 13, 14, 18 and 20 under 35 U.S.C §103(a) as being unpatentable over Fraden (US 4,509,527) in view of Miller (US Patent No. 5,796,340). According to the Examiner, Fraden disclose *inter alia*, generating at least one horizontal signal by subtracting at least one said vertical pressure signal from another vertical pressure signal (page 3 lines 4-6 of the Office Action). According to the Examiner this limitation is supported in Fraden in Col. 5 Line 63 – Col. 6, Line 3. Applicant respectfully traverses. Fraden merely teaches a sheet-like transducer that may be made to fit the size of any mattress in order to be responsive to the substantially vertical, cyclical motions transmitted to the transducer

by the patient's hear beat and respiration regardless of the patient's position on the mattress (Col. 4, Lines 2-7). Thus, Fraden teaches a single transducer that converts vertical pressure changes into a single signal that is later analyzed for extracting the heart beat. Fraden therefore does not teach and cannot suggest any use of a plurality of transducers/sensors that are necessary (though not sufficient) to obtain at least two vertical pressure signals from two different locations in order to generate in turn at least one horizontal signal by subtracting at least one said vertical pressure signal from another vertical pressure signal.

More specifically, in Col. 5 Line 68 – Col. 6 Line 3 Fraden teaches the capability of detecting horizontal translation of the center of gravity due to respiratory activity as well as substantially vertical displacement due to cardiac activity. Applicant submits that that by this Fraden merely suggests that horizontal movements due to respiratory activity may also be manifested in the signal obtained from the single sheet-like transducer. Conversely, embodiments of the present invention may obtain a plurality of vertical pressure signals and generate therefrom a horizontal signal. Thus, the word "horizontal" as used in Fraden refers to movements of the patients that affect the obtained signal wherein the word "horizontal" as used in the present invention relates to a signal generated by the disclosed method and system. More specifically, Fraden relates to horizontal movements due to respiratory activity whereas the present invention relates to generating a horizontal signal from which information regarding the blood circulation of the patient may be obtained.

Applicant further submits that Miller also does not teach any generation of a horizontal signal by subtracting two independently obtained vertical signals simply because, like Fraden, Miller teaches a mattress with a single transducer that converts pressure variations due to respiratory and cardiac activity into electrical signals that are analyzed for extracting heartbeat and respiratory rate. One transducer can generate one signal only and thus no generation of a horizontal signal by subtracting two independently obtained vertical signals is possible.

Examiner submits that Miller teaches in Col. 5, Lines 8-10 analyzing at least one horizontal signal for identifying and detecting heart beat rate. Applicant respectfully transverses and submits that Miller does not and cannot teach this, specifically not in Col. 5, Lines 8-10 but also nowhere else. As mentioned above,

Miller does not generate or even obtain such a horizontal signal that is the result of subtracting two independently obtained vertical signals.

Applicant further submits that any combination of Miller and Fraden would not yield a generation of a horizontal signal by subtracting two independently obtained vertical signals. Both Miller and Fraden teach a single transducer/sensor that generates single signal. Thus it would not have been obvious for a person having ordinary skills in the art to combine Miller and Fraden to achieve independently obtained vertical signals necessary for the creation of the horizontal signal as disclosed in the claimed invention.

Notwithstanding the above, and in order to advance prosecution of the present application, Applicant has redrafted a new independent claim 22 reciting the aforementioned limitations. Specifically, new claim 22 includes, *inter alia*, sensing using a first pressure sensor located beneath the subject at a first location, a first vertical pressure signal exhibiting variations over time of vertical pressure applied by the subject on the first location; sensing using a second pressure sensor located beneath the subject at a second location, a second vertical pressure signal exhibiting variations over time of vertical pressure applied by the subject on the second location; subtracting the first vertical pressure signal from the second vertical pressure signal thereby creating a horizontal pressure signal exhibiting horizontal pressure variations over time attributed to the subject's blood circulation; and analyzing the horizontal pressure signal for extracting the subject's heartbeat rate.

Applicant submits that new claim 22 now clearly recites the limitation of creating a horizontal pressure signal by subtracting one independently obtained vertical pressure signal from another independently obtained vertical pressure signal. The horizontal signal is then used for extracting the heartbeat rate of the patient.

Applicant submits that claim 22 patentably defines over the combination of Miller and Fraden.

Similarly, Applicant has amended independent system claim 11 to recite the aforementioned limitations and specifically, amended claim 11 now recited *inter alia*, at least two independent pressure sensors located beneath the subject's body for sensing vertical pressure signals exhibiting variations over time of vertical pressure values at different locations; an electronic mechanism for subtracting at least one vertical signal from another vertical signal thereby creating at least one horizontal

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pressure signal exhibiting horizontal pressure variations over time attributed to the subject's blood circulation ; and a processing module for analyzing the at least one horizontal pressure signal to identify and detect the heartbeat rate.

Applicant submits that claim 11 as amended patentably defines over the combination of Miller and Fraden and withdrawal of the rejection under 35 U.S.C 103(a) is respectfully requested for claims 11.

Similarly, all dependent claims 2-10 and 12-21 now recite the above mentioned limitations *mutatis mutandis*, by virtue of their dependencies.

Therefore, withdrawal of all other rejection under 35 U.S.C 103(a) is respectfully requested for claims 2-10 and 12-21.

#### Conclusion

In light of the foregoing remarks, this application is now in condition for allowance, and early passage of this case to issue is respectfully requested.

If any questions remain regarding this response or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

Fees for a two month extension of time and an RCE are believed to be for this submission. However, please charge any required fee (or credit overpayments) to the Deposit Account of the undersigned, Account No. 500601(Docket No. 7044-X06-010).

Respectfully submitted,  
/Paul D. Bianco/  
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